

# A. C. RAND'S Apparatus for Burning Coal. 2 Sheets--Sheet 1.

No. 119,719.

Fig. 1.

Patented Oct. 10, 1871.

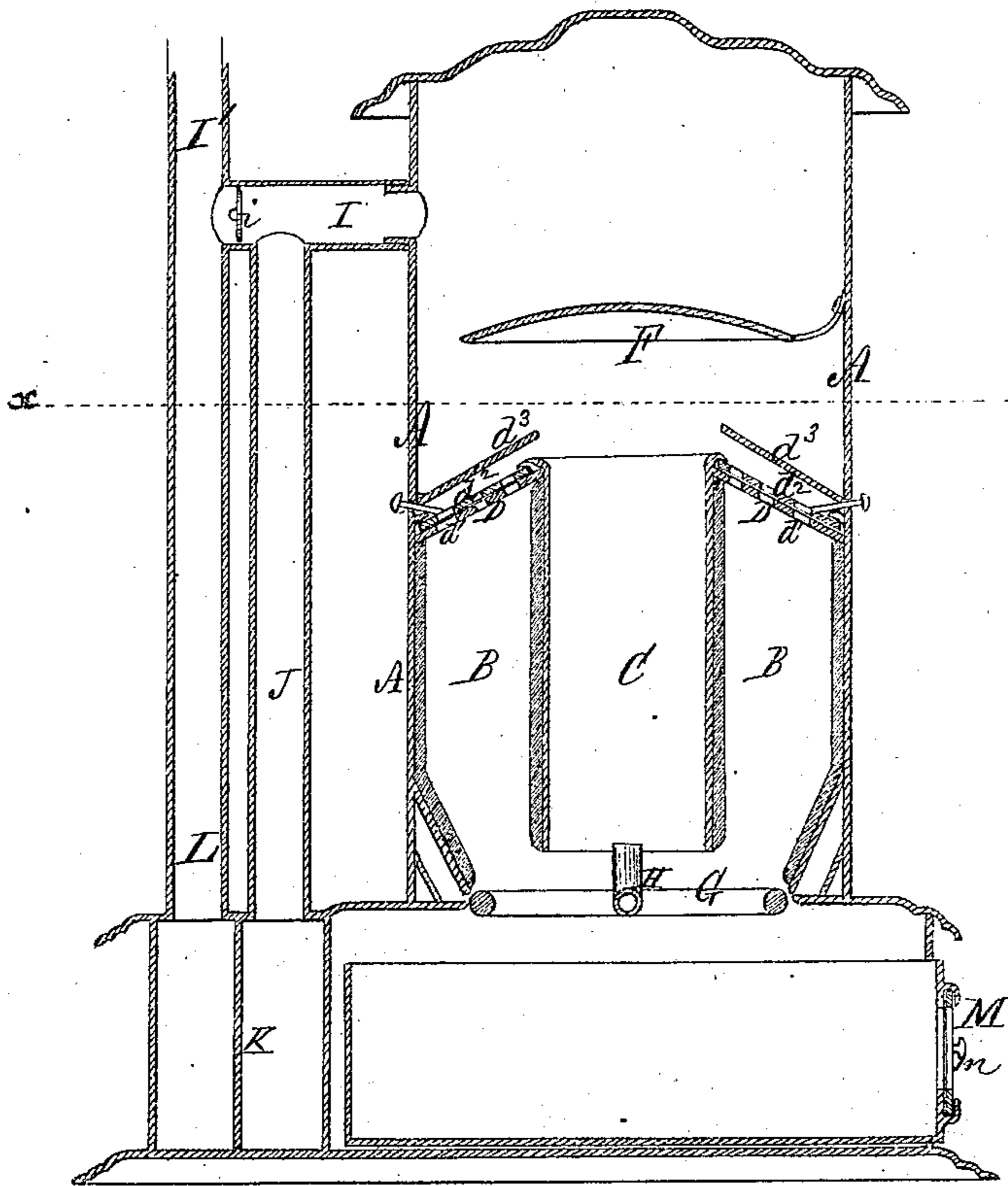
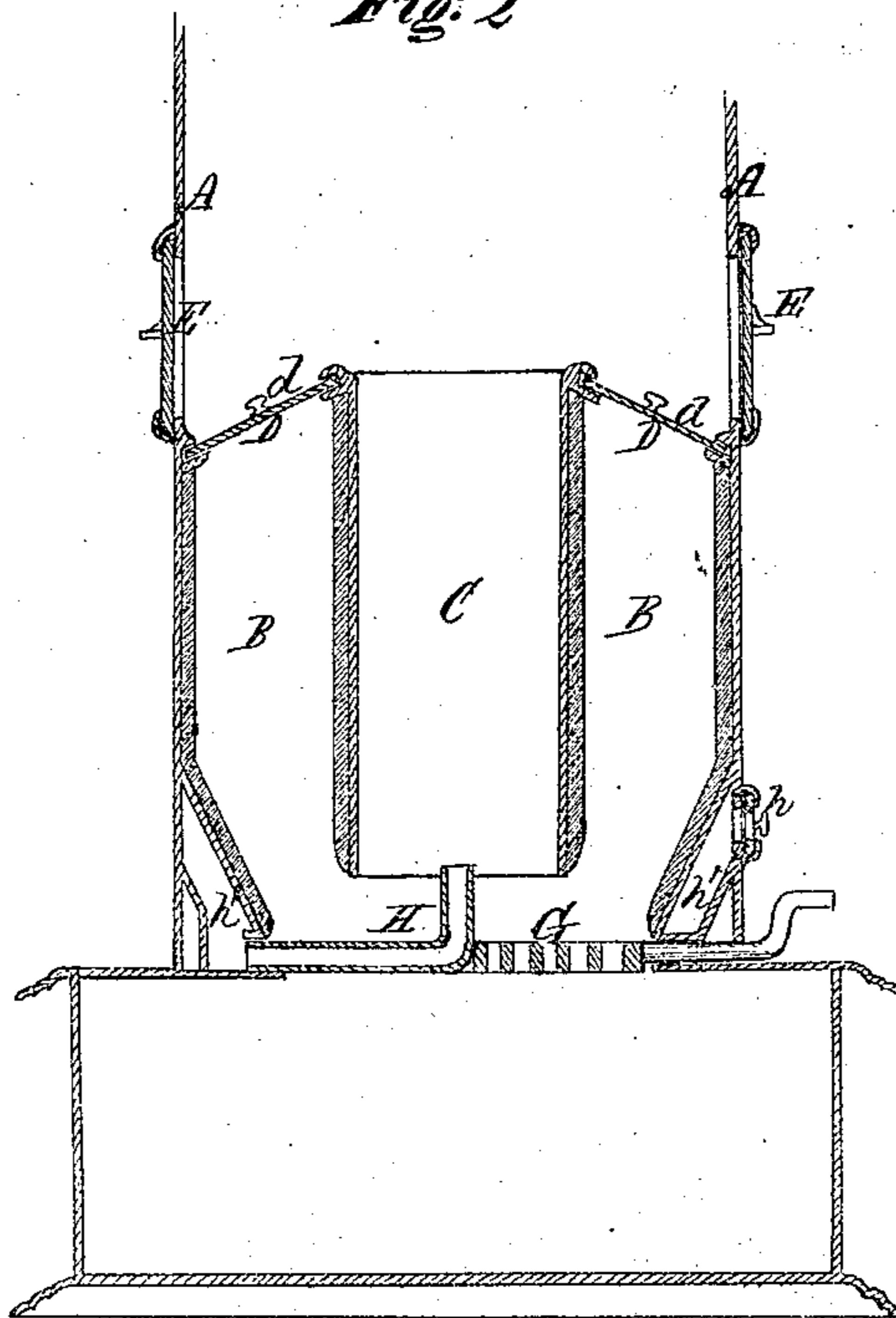


Fig. 2



WITNESSES.

James S. Rankin

J. G. Trifunhagen

Inventor.

A. C. Rand

By  
Peck & Miatt  
Attorneys

Chicago Ill

No. 119,719.

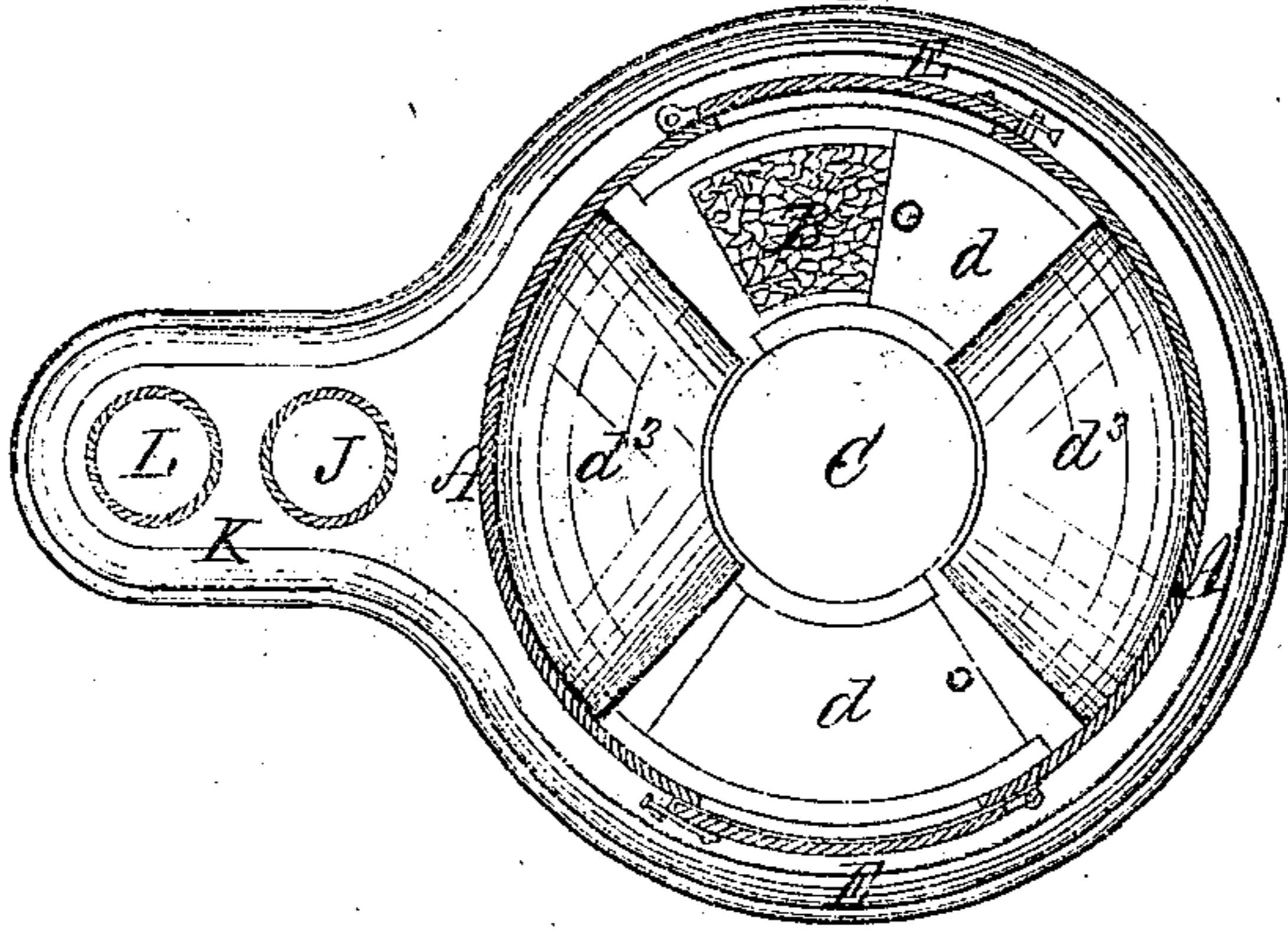
A.C. RAND'S

2 Sheets--Sheet 2.

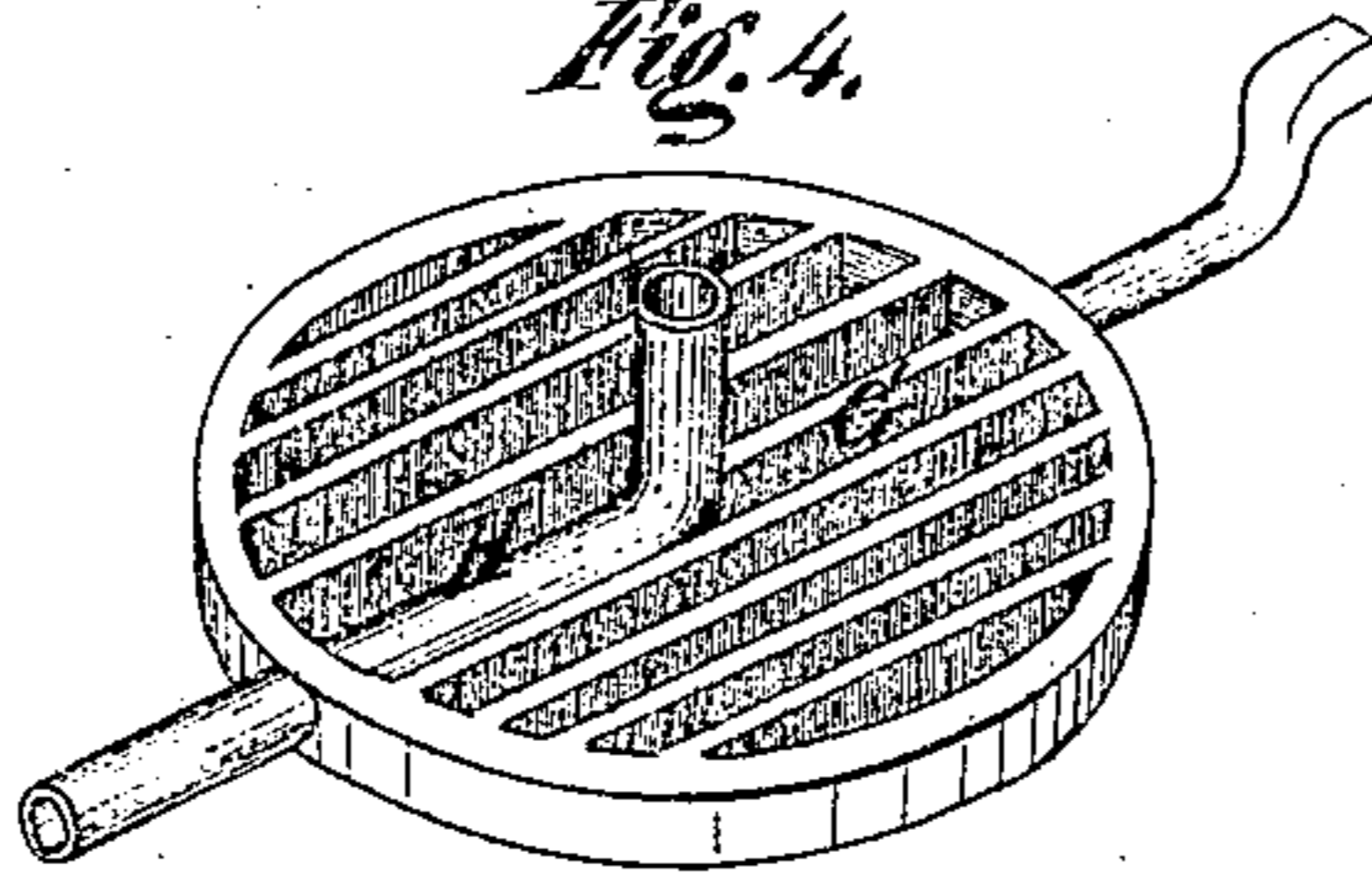
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*Apparatus for Burning Coal.*

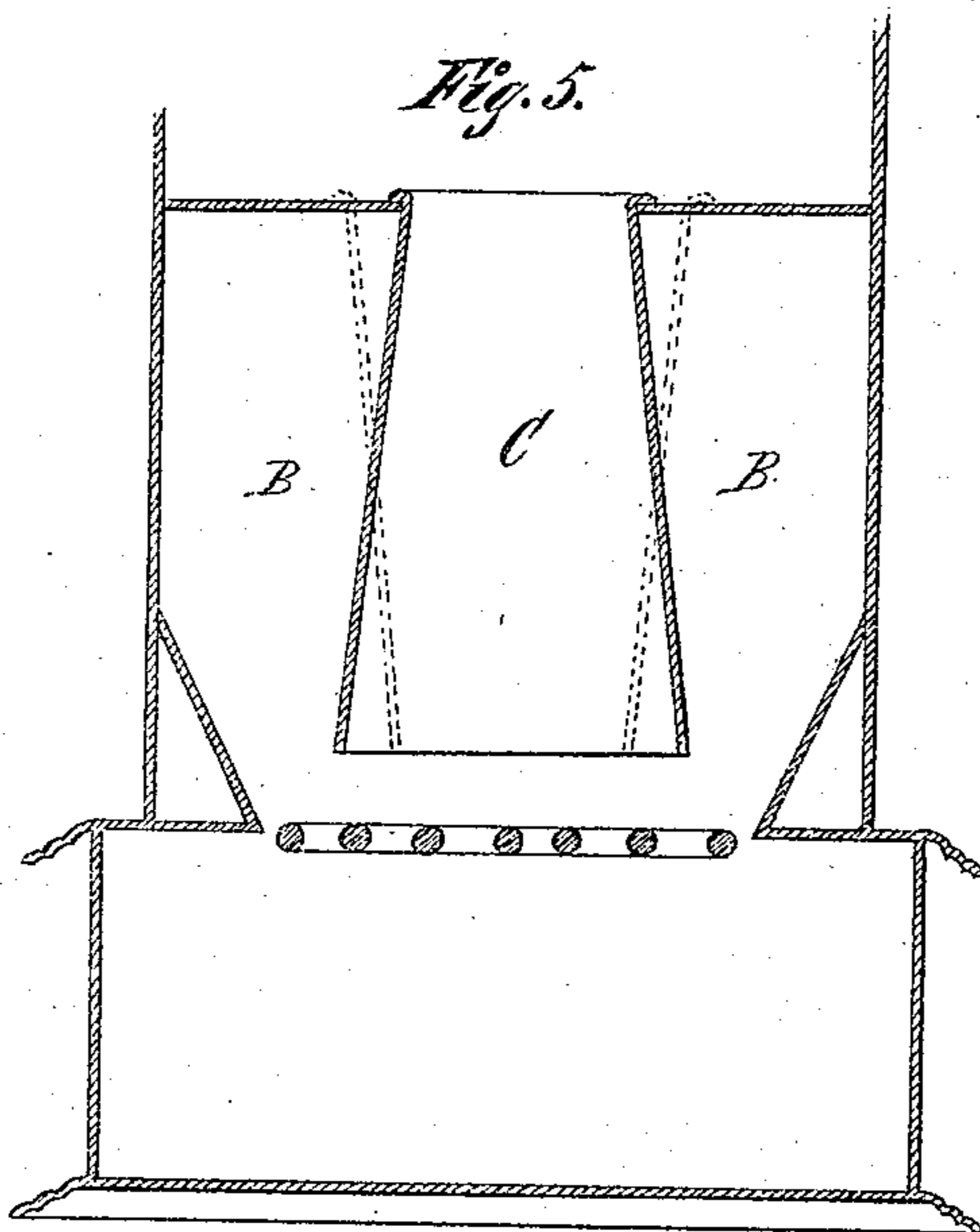
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



WITNESSES.

James S. Rand,  
J. G. Copenhagen

Inventor:

A. C. Rand  
By  
Peck & Miall  
Attorneys  
Chicago, Ill.

# UNITED STATES PATENT OFFICE.

ALONZO C. RAND, OF CHICAGO, ILLINOIS.

## IMPROVEMENT IN HEATING-STOVES.

Specification forming part of Letters Patent No. 119,719, dated October 10, 1871.

*To all whom it may concern:*

Be it known that I, ALONZO C. RAND, of the city of Chicago, in the county of Cook and State of Illinois, have invented an Improved Furnace for the more perfect combustion of coal, of which the following is a specification:

The nature of this invention relates to the more perfect combustion of bituminous and other coals in stoves, ranges, locomotives, &c.; and the object is attained by an arrangement of the draught by which all the gases from the burning coal are kept at a high or constantly increasing temperature from the time of their birth till their combustion is perfect, in the manner hereinafter described.

In the drawing, Figure I is vertical cross-section of a stove or furnace, showing the application of my device; Fig. II, a similar view, in plane, at right angles to Fig. I; Fig. III, a horizontal cross-section, in plane of line *xx*, Fig. I; Fig. IV is a perspective view of the grate. Fig. V, a diagram, showing modifications in the arrangement of the central flue.

A is the outer casing of a plain form of stove or furnace. B is the coal-magazine, provided with a central flue, C, and closed top D. This top has a close-fitting door, *d*, on the two sides, for the admission of coal, and is also provided with small holes *d*<sup>1</sup>, protected by dampers *d*<sup>2</sup>. Over the holes *d*<sup>1</sup> are placed shields or guides *d*<sup>3</sup>. Slide-doors E communicate with the top D, and a heat-deflector, F, is placed above the central flue C. A grate, G, is furnished with an air-tube, H, projecting upward to or into the bottom of the central flue C. This air-tube has an independent communication with the outer air through the damper *h* and compartment *h'*. I represents the escape-pipe, which is supplied with a damper, *i*, for the purpose of directing the heated products of combustion, when desired, downward through the pipe J into the radiator-box K, and thence upward, through the pipe L, into the direct-draught pipe I'. M is the door, having a damper, *m*, through which ashes, &c., are withdrawn.

The operation of the invention is as follows: The fire is first started by introducing kindlings and coal through the doors E and *d* and magazine B to the plate G, and applying a match beneath the said grate through the door M. The doors E and *d* having been closed before apply-

ing the match, and the damper *i* opened wide, a strong and direct draught is immediately established through the central flue C and escape-pipe I. The damper *h*, through which air is supplied to the air-tube H, should remain closed until the coal becomes fully ignited. If desired, the magazine B may be entirely filled with coal before lighting the fire. The damper *d*<sup>2</sup> may be allowed to remain open until the whole body of coal in the magazine becomes moderately heated, or for any length of time if a rapid fire is required. After the coal has become fully ignited the damper *h*, communicating with the heating-chamber *h'* and tube H, may be opened in order to supply the gases and vapors—the combustion of which has not been completed in passing through the incandescent fuel under the mouth of the central flue C—with fresh-heated oxygen, and also, while the damper *m* remains open, to increase the draught through the layer of coal between the flue C and grate G. The damper *i* may be closed after the fire is well started, and the heated results of combustion conducted through the radiator K, pipes J and L, as before described.

The principle upon which this furnace is constructed is that of preventing the formation of smoke by increasing the temperature of the gases and vapors arising from incandescent coal from the time of their birth until the process of combustion is complete. Smoke is the result of cooling and condensing the gases arising from burning fuel before the chemical change known as combustion is completed. As an illustration of this fact I may refer to the well-known result of a draught of cold air on rich coal-gas in producing smoke, while a current of heated air fails to develop any smoke. Again, all know that a fire burns with less smoke after it has been kindled some time than when first ignited. The object of my invention is to apply this principle by so regulating the draught that all the gases formed will be brought in contact with the hottest portion of the fire in such a manner that their temperature shall be increased, or at least maintained, from the time of their birth until combustion is complete.

The construction of the magazine in relation to the central flue is such that the layer of coal on the grate is sufficiently thin to admit of a strong draught through the said layer into the central flue and escape-pipe; and as the top of

the magazine has a tight cover all the gases generated must pass through the burning coal under the mouth of the flue. The fierce heat at this point would alone be nearly or quite sufficient to perfectly utilize the fuel; but, in order to make this result certain, an independent communication is opened with the outer air through the damper *h*. Air entering through this damper by reason of the suction created by the draught through the flue *C* is carried around the compartment *h'* in contact with the base and hottest part of the magazine, and then into the axial passage and tube *H*, through the red-hot coal, and discharging into the midst of the burning vapor in the central flue *C*, thus promoting a great increase of temperature. The deflector *F*, when used in stoves, assists in radiating the heat by causing the column of heated products of combustion rising through the central flue to impinge against the sides of the cylinder *A*. When the small holes *d*<sup>1</sup> in the top *D* are allowed to remain open, in order to induce a slight current through the mass of coal in the magazine, all gases escaping from said holes are conducted, by the shield or guide-plates *d*<sup>3</sup>, into the current of burning gas escaping from the central flue *C*.

The advantages I claim for this invention are of more than ordinary importance. The theory upon which most stoves, furnaces, &c., which have any reference to avoiding the escape of smoke have been built has been that of consuming it after it has been formed. The objection to this principle of operation is that when the gases are once allowed to cool the resultant smoke represents simply so much fuel, and as many units of heat will be required to again attain the temperature necessary for its perfect combustion as was originally required to convert it into a gaseous

state. Oxygen combines with carbon in two definite proportions, namely: six of the latter to eight of the former, producing carbonic oxide; or six of the latter and sixteen of the former, producing carbonic acid. The latter product is the resultant of complete combustion, involving a high temperature; the former, that of incomplete combustion, induced by a low temperature. Hence the necessity of maintaining a high temperature of the gases after being evolved from the coal.

Having thus fully described the objects, operation, and advantages of my invention, I will proceed to claim what I believe to be original with myself, and what I desire to secure by Letters Patent, namely:

1. The coal-magazine *B*, having closed top *D* and doors *d*, in combination with the flue *C*, deflector *F*, and air-tube *H*, as set forth and described.

2. The air-tube *H* penetrating upward through the layer of coal on the grate *G*, and opening into the flue *C*, substantially as and for the purpose described.

3. The heat-deflector *F*, when combined with the coal-magazine *B* having a central flue, *C*, for the object described.

4. The heating-compartment *h'*, in combination with the tube *H*, grate *G*, flue *C*, and deflector *F*, substantially as described.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

A. C. RAND.

Witnesses:

GEO. W. MIATT,  
J. B. GREIFENHAGEN.

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